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ABSTRACT

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Antonym Adjective Contexts and the Facilitation of Noun Pair Learning in Children[1]

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Abstract

Second and sixth graders were asked to learn noun pairs linked by various types of verbal connectives: verbs, unmarked and marked comparative adjectives, polar antonym adjective pairs, and conjunctions. Results indicated that all contexts produced better learning than conjunctions, that comparative adjective effects were comparable to verb effects, and that both of these sentence contexts were superior to the polar-pair condition which consisted of conjoined noun phrases. Also, in all conditions, first- and final-position nouns were found to prompt equivalent recall. Results provide compelling evidence for the operation of adjective structures as mnemonic organizers in younger as well as older children, and they challenge imagistic accounts of the verb facilitation effect.

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Numerous investigations exploring factors which facilitate the learning of English noun pairs have been undertaken by Rohwer and associates (Rohwer, 1967). Studies comparing the effects of verb, preposition and conjunction connectives have in general found that noun pair learning proceeds most rapidly in verb contexts, less rapidly when prepositions link the two nouns, and least rapidly when conjunctions serve as connectives (Rohwer, Lynch, Levin & Suzuki, 1967). Not only verbal but also visual factors have been shown to produce facilitation. In a study where pictorial stimuli analogous to the verbal connectives used above accompanied the noun pairs, Rohwer, Lynch, Suzuki & Levin (1967) found that the greatest boost in performance resulted when the pictures depicted action between the two objects, less facilitation occurred in still pictures portraying spatial relationships, and the least facilitation resulted when objects were depicted side by side without any common context. Based upon these parallel findings for verbal and pictorial modes, Rohwer (1967) has postulated that visual imagery processes underlie and account for the form class effect. Both pictures and words arouse in the minds of learners images of the object pairs. Actional images serve to synthesize and thus preserve the nouns in memory better than locational images, and, in turn, locational images better integrate the pairs in memory than coincidental images.

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Other investigators have drawn similar conclusions about the role of imagery in learning. Paivio (1967) has repeatedly demonstrated that both concreteness and imagery ratings of nouns are potent predictors of learning ease. Bower (1970) has found that subjects told to imagine a visual interaction between objects denoted by two nouns recall more pairs than subjects instructed to generate other kinds of contexts. Davidson & Adams (1970) report that children are able to remember pairs of pictures when the objects overlap, but when objects are drawn side by side, their recall is devastated. Such findings have led investigators to postulate an imagistic coding system which can be invoked by learners to represent and store information in memory (Paivio, 1969; Bower, 1970).

The importance of imagery in learning cannot be disputed. However, the capacity of this construct to account for all facilitation phenomena is questionable. For instance, it is not clear that actional images underlie the effects of verb connectives. Rohwer & Levin (1968) varied the amount of verb activity denoted and found that action verbs (e.g., Roses drink rain) produced no faster noun pair learning than still verbs (e.g., Roses like rain). Reese (1970) reports similar results showing that specific, vivid images aroused by connectives between nouns are not necessary. Even when one very general nonspecific verb (i.e., "goes with" or "has") links every noun pair in a list, learning is facilitated. These and other findings have prompted Rohwer (1970) to modify his position and to consider the explanatory capacity of verbal constructs. He points out that whereas language offers a coherent well-organized system for representing information, imagery does not. Rather it involves more ad hoc means for coding stimuli in memory.

Researchers who have examined the potential of linguistic structures for predicting patterns of learning have reported positive results. Both Suzuki & Rohwer (1968) and Davidson & Dollinger (1969) have shown that deep structure integral subject-object relations between nouns must obtain in order for facilitation to occur. Ehri (1970) has used deep structure case relations to account for facilitation. However, these researchers in their preoccupation with grammatical structures have not excluded the possibility that imagery rather than verbal structures account for their results. One could argue that sentences found to enhance learning were also sentences which aroused more highly integrated images for noun pairs.

Since imagistic and linguistic coding systems have been proposed as alternative explanations for the effects of various connective types on recall, it is necessary to examine the predictive power of each construct. The present study was intended to do this. In a task utilizing verbal contexts as aids to noun pair learning, the effects of verb connectives were compared to the effects of connectives which do not arouse overlapping or action-packed images for noun pairs but rather depict the objects side by side, similar to images depicted by conjunction connectives. Two types of antonym adjective forms provided this sort of context, a comparative construction:

The snake is longer than the cigar. (1a)

The cigar is shorter than the snake. (1b)

and a polar noun-phrase form:

The long snake and the short cigar. (2)

These contexts were used to test alternative predictions derived from imagistic and linguistic positions. It was reasoned that, if imagery processes are at the root of the form class effect, then learners given verb connectives should perform better than learners given adjective contexts, and recall in the latter group should not differ from control subjects given conjunctions. However, if linguistic structures serve as effective mnemonics for noun pairs, then subjects given adjective connectives should perform significantly better than conjunction controls and perhaps as well as learners given verbs.

That antonym adjective pairs can be regarded as linguistic structures is suggested by Deese (1965) and his analysis of word associations. He find that these adjectives most frequently elicit their opposites, that this relationship is reciprocal, and that such a reciprocal relationship serves to identify all contrast pairs and no false positives. Deese concludes that a very considerable portion of adjective meaning can thus be directly described by the polar-opposite scheme.

Clark & Card (1969) have also explored the nature of adjective structures. They assert that the relationship between many antonym pairs is not symmetrical. Rather one member differs from the other by having one additional semantic feature: [- Polar]. This term is referred to as "marked" in contrast to its opposite, the "unmarked" term which (1) can be used with neutral meaning, and (2) refers to both a region on a scale and the name of the scale itself. For example, asking "How long is the pencil?" implies nothing about the speaker's expectations, while inquiring "How short is the pencil?" involves a presupposition that the pencil is short. And replying "It is two inches long" is acceptable, while answering "It is two inches short" is not. Thus, "long" is considered unmarked and "short" marked. In a free recall learning task with comparative sentences as stimuli, Clark & Card (1969) found that subjects tended to substitute unmarked for marked adjectives much more frequently than they did the reverse, and they remembered sentences containing unmarked adjectives better than sentences with marked adjectives.

These findings suggest that antonym adjectives can be regarded as lexical representatives of bipolar dimensional structures. The present study was designed to provide additional evidence for the notion that these structures comprise part of the linguistic coding system useful for organizing information in memory. Both types of comparative connectives were examined, unmarked forms (e.g., Sentence (1a)), and their marked counterparts (e.g., Sentence (1b)). It was reasoned that learners, especially children, might have more difficulty remembering nouns linked by marked adjectives since these are thought to be more complex and less central, i.e., they possess one more semantic feature and do not denote the scale itself but only its negative pole. In addition to contrasting learning with two comparative forms, performance with a third construction, a noun phrase form which resembled the comparative forms semantically but not syntactically, was included in the contrast (see Sentence (2)). It was reasoned that if antonym pairs do activate underlying dimensional structures during learning, then one would expect both form types to preserve noun pairs in memory and thus facilitate recall. However, although underlying meanings are comparable, it may be that, for maximal facilitation to occur, relations aroused between nouns must be stated explicitly in the form of complete sentences rather than implicitly in the semantic structures of conjoined noun phrases. If this is the case, then learners given comparatives should outperform learners given noun phrases.

In the construction of sentences, the order of nouns in unmarked comparatives was always the reverse of corresponding marked-comparative noun orders. In order to insure that any resulting performance differences could be attributed to variations in verbal context rather than to whether particular sets of nouns performed stimulus or response roles during recall, the position of the noun prompt was varied. Half the time first nouns served as test cues and half the time final nouns appeared. Thus, Ss in the marked condition were given the same noun prompts as Ss in the unmarked condition. This variable was manipulated not only for purposes of control but also because of its relevance for alternative theories of verbal memory. Reese (1970) has suggested that sentences constitute a type of Gestalt. Lashley (1951) argues similarly that, in contrast to surface forms whose parts are temporally ordered, underlying thoughts or ideas exist simultaneously as aggregates or configurations. Since noun pairs are thought to be remembered primarily in terms of underlying semantic relations aroused by verbal contexts, noun position should bear little relation to the retrievability of these relations. Although this prediction is confirmed in a study by Ehri (1970), the results of experiments by Davidson (1969) and by Clark & Card (1969) indicate that first nouns are more salient in memory than final nouns. The presence of serial position effects in the latter two studies can be cited as evidence for either an associationistic position, which describes learning as the acquisition of verbal S-R chains, or a psycholinguistic position, which holds that the surface-structure subject of a sentence being the focus of attention is more dominant in memory than the predicate. Although resolution of these alternative view points is not attempted in the present study, additional evidence is sought.

The final independent variable examined involved grade level (second vs. sixth) and was included in order to add a developmental dimension to the exploration of processes discussed above. Also, some specific hypotheses were tested. Rohwer (1967) has found that verbs enhance learning in children as young as preschool age. However, there is basis for doubt about whether adjectives will be able to function similarly, especially for younger children. First, Bruner, Olver, Greenfield, et al. (1966) claim that children utilize ikonic means for representing information before they master symbolic systems. Since verbs are thought to possess superior ikonic power, they should enhance noun pair learning more than adjectives, especially in younger subjects. Second, Entwisle (1966) in her study of children's word associations concludes that contrast adjective pairs are still being learned by second graders. She finds that antonyms tend to elicit each other with increasing frequency from first to third grade and also that the number of adjectives given as responses to nouns increases substantially. Her observations suggest that between the ages of six and eight, children are in the midst of forming adjective structures and using them to categorize nouns in terms of their salient attributes. Since these linguistic structures are only incompletely formed by the second grade, it is unlikely that they can serve very effectively as mnemonic tools. Thus, adjective facilitation effects were expected to be less substantial for second than for sixth graders in the present study.

To review, the specific aims of this investigation were to discover whether antonym adjective connectives could facilitate the learning of noun pairs, whether adjective facilitation effects would be as substantial as those produced by verb connectives, whether the type of adjective connective (marked or unmarked comparatives, or polar noun modifiers) made any difference, whether location of nouns in sentences affected their cuing capacity, and, finally,

whether any of the effects obtained were stronger in sixth graders than in second graders. Results were expected to carry implications for imagistic and linguistic theories of memory.

Method

Tasks. A prompted recall task was utilized. Subjects were presented with pairs of nouns embedded in sentences or conjunction-linked noun phrases and were asked to learn the nouns so that when given either one they could recall the other which had accompanied it. Following two sets of study-test trials, subjects were surprised with a request to recall entire verbal contexts.

Materials. Five types of verbal contexts were created for noun pairs. Three of these formed complete sentences. Each is labeled and illustrated below:

1. Verb: The broom is sweeping off the elephant.

2. Unmarked or Maxi-adjective: The elephant is fatter than the broom.

3. Marked or Mini-adjective: The boom is skinnier than the elephant.

4. Polar-pair: The skinny broom and the fat elephant

5. Conjunction: The broom and the elephant

The first type consisted of nouns linked by present progressive verb constructions, some of which contained particles or prepositions. These functors were included in 75 per cent of the verb strings in order to render these sentences more similar to the adjective strings in length. Also, the procedure of including both one- and two-unit verbs expanded the number of possible verb contexts, making it easier to find appropriate connectives for noun pairs. Since in a previous study (Ehri & Rohwer, 1969) such variations in verb construction were found to have no differential effect on learning, this procedure appeared justified.

The second, third and fourth types of contexts all contained antonym adjectives. Sixteen pairs of antonyms were selected, and for each the unmarked-marked distinction was imposed. Because some of the pairs remained ambiguous in this respect, the decision criteria used by Clark & Card (1969) (see above) were modified to resolve this ambiguity. The following test was applied to questionable pairs. First, the underlying attribute being varied was identified (e.g., for the pair, dirty-clean, it was amount of dirt). Then, the term which referred to the end of the continuum approaching zero was regarded as the marked or mini-adjective (e.g., zero amount of dirt signifies the pole clean). The term denoting the other end of the continuum, the end which appears to be increasing endlessly, was considered the unmarked or maxi-adjective. The following maxi-mini pairs were employed in the present study: fat-skinny, large-small, happy-sad, hot-cold, high-low, long-short, rich-poor, fast-slow, old-young, pretty-ugly, strong-weak, big-little, heavy-light, dirty-clean, hard-soft, rough-smooth. The modified decision criteria were invoked for the last three pairs listed. Except for the pair "dirty-clean," the maxi-mini

distinction corresponded to the unmarked-marked analysis performed by Clark & Card (1969).

The fifth type of context served as the control and consisted of noun pairs linked only by conjunctions. Resulting word strings were necessarily shorter than the other types of contexts.

Two sets of sixteen noun pairs were composed, each set comparable in terms of noun frequency based on Thorndike-Lorge (1944) counts. These nouns were not selected arbitrarily. Rather pairs were chosen whose referents possessed the attributes described by the adjectives. The same noun pairs were used in all five verbal contexts. Whereas entire word strings were presented during the study trials, only single nouns appeared as cues for recall. All materials were typed on white memory-drum tape. Noun pairs were underlined. The order of item presentation within each list was determined randomly, with a different order for study and test trials.

Subjects. The S sample consisted of 160 second- and sixth-graders drawn from two middle-class public elementary schools. Eight children, half male and half female, from each grade and school were randomly assigned to each of the five experimental groups.

Design. A design consisting of a 2 x 5 x 2 factorial was used to assess the influence of the three independent variables on noun recall and string recall. The first factor, grade, contrasted performances of second graders and sixth graders. The second variable, verbal context, compared five types of noun-pair connectives: verbs, comparative maxi-adjectives, comparative mini-adjectives, polar adjective pairs, and conjunctions. The third factor, noun prompt position, was nested within each level of the second factor and consisted of a variation in the sentential position of the noun test cue, initial position versus final position. The first two variables were manipulated by means of independent groups while the third variable was a repeated measure.

Analysis of variance with planned orthogonal comparisons was used. Contrasts were constructed so as to deal with the major experimental questions regarding verbal context effects. Specific contrasts of interest were:

$$\hat{\Psi}_1 = \frac{(\bar{X}_{Verb} + \bar{X}_{Max} + \bar{X}_{Min} + \bar{X}_{Pair})}{4} - \bar{X}_{Conj}$$

$$\hat{\Psi}_2 = \bar{X}_{Verb} - \frac{(\bar{X}_{Max} + \bar{X}_{Min})}{2}$$

$$\hat{\Psi}_3 = \bar{X}_{Max} - \bar{X}_{Min}$$

$$\hat{\Psi}_4 = \frac{(\bar{X}_{Verb} + \bar{X}_{Max} + \bar{X}_{Min})}{3} - \bar{X}_{Pair}$$

The first contrast tests whether any of the elaborated verbal contexts produced facilitation relative to conjunction controls. The second contrast examines whether comparative adjective constructions enhanced learning as much as verb connectives. The third contrast provides a test of the relevance of the unmarked-marked distinction for noun-pair learning. And the final contrast is intended to determine whether learning is boosted when relations are stated explicitly as sentences rather than implicitly as noun phrases.

Procedure. The task was administered individually by a study-test method. Stimuli were presented on a memory drum and were also read aloud by the E at a 5:5 second rate. Ten seconds intervened between the study and test trials. Ss responded orally during the tests, and their recall was recorded on tape.

Prior to the beginning of the task, Ss were given practice on four examples. In order to assess the effects of reading difficulty on performance, E asked Ss to read aloud the examples and he noted whether they were able to comply. Performance, however, was not expected to be substantially impaired by this factor since the E presented orally all stimuli appearing on the memory drum during the experiment.

Although each subject was asked to recall an equal number of first- and final-position nouns, all subjects in each experimental group did not hear the same prompts. Half were given a random assortment of first and final nouns, and the other half received the oppositely positioned nouns as prompts. This procedure was used to insure that position rather than particular noun prompts accounted for any obtained recall differences. Since control was the objective, the effects of these randomly chosen sets of noun prompts were not evaluated.

Results

Learning was measured in terms of the number of correct nouns recalled during the two test trials. Also, various aspects of the string recall task were examined. Hypotheses were tested at $p < .01$, and post hoc comparisons were conducted at $p < .05$. The main results are presented in Table 1. An analysis of variance on noun recall revealed no main effects or interactions

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Insert Table 1 about here.

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involving the factors sex, school, or lists, indicating that other results can be generalized across these groups.

Congruent with findings of a previous study utilizing similar mixed list procedures (Ehri, 1970), the factor noun prompt position was found to exert no differential effect on recall in any of the experimental conditions (overall $F < 1.00$). Thus, the first noun of a sentence or pair of noun phrases does not appear to be more salient than the final noun in the underlying configuration stored in memory, at least in PAL tasks when noun retrievability is used as the index.

Main effects of both grades (F (1,140) = 21.33, $p < .01$) and trials (F (1,140) = 516.91, $p < .01$) were uncovered. Also, an interaction between these two factors appeared (F (1,140) = 6.85, $p < .01$), the only interaction involving the factor grades. These results are displayed in Table 2 and show that the performance of sixth graders was superior to that of second graders,

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Insert Table 2 about here.

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that recall on Trial 2 exceeded Trial 1 recall, and that gains in learning resulting from a second exposure to the stimuli were significantly greater for sixth than for second graders. These findings are consistent with the general notion that mnemonic systems, being more fully developed, function more effectively for sixth than for second graders.

Planned comparisons designed to analyze specific verb context effects revealed that differential amounts of learning were produced by the various connectives. The first contrast, $\hat{\Psi}_1$, constructed to test for facilitation effects, was significant at F (1,140) = 41.63, $p < .01$. Post hoc procedures using Dunnett's test disclosed that each of the four context conditions resulted in levels of learning which were superior to that in the conjunction control group ($p < .05$). Thus, both polar and comparative adjectives as well as verbs facilitated learning in the present study. The means are displayed in Table 1. These results support the hypothesis that verbal structures without the aid of rich images can operate to enhance learning.

The second and third contrasts were not found to be significant, with F (1,140) = 2.90, $p > .01$ for $\hat{\Psi}_2$, and $F < 1.00$ for $\hat{\Psi}_3$. These results indicate that amounts of facilitation produced by comparative maxi-adjectives, comparative mini-adjectives, and verbs were all comparable. Thus, verbs are not more effective mnemonics than adjectives. And the linguistic distinction drawn between unmarked and marked adjectives does not appear to be relevant to noun-pair learning.

The final contrast, $\hat{\Psi}_4$, was significant, with F (1,140) = 11.93, $p < .01$. This finding makes it clear that, although polar forms, comparative forms, and verbs can boost learning, the boost is substantially greater when the relation between nouns is stated explicitly in the form of a sentence. Implicit relations expressed as noun modifiers and spanning two noun phrases operate only weakly to enhance recall.

Not only noun recall but also performance in a surprise string recall task was examined in the present study. An analysis of variance applied to the number of correct noun-pair connectives revealed no significant differences as a function of verbal context, F (3,112) = 2.79, $p > .01$, although the mean for the polar pair condition was somewhat lower than the other means. (The control group was not included in this analysis.) These results are presented in Table 3 and indicate that, contrary to expectations, marked or mini-adjectives were

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Insert Table 3 about here.

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remembered as well as unmarked or maxi-adjectives.

Clark & Card (1969) reported that comparatives containing marked adjectives were transformed into their unmarked counterparts more often than unmarked were changed into marked forms during recall. Although relatively few such errors occurred in the present study, the same phenomenon was observed. These results, presented in Table 4, show that over twice as many mini-comparatives were trans-

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Insert Table 4 about here.

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formed into maxi-comparatives as maxi-comparatives were changed in mini-comparatives. Another asymmetrical recall pattern was also uncovered and is evident in Table 4. Comparative transformational tendencies appear to be strongly influenced by the position of the noun prompt. Whereas 19 transformations were elicited by first nouns, 45 appeared with final nouns. This is similar to the finding reported by Ehri (1970) for passive-to-active transformations. Such alterations are claimed to occur as a consequence of generative strategies invoked by the subject. That is, when he cannot remember the exact form of a sentence but only its meaning, he is inclined to select a grammatical form which places the noun prompt at the beginning of his utterance.

The foregoing patterns of recall produced by variations in verbal context were evident in the performances of second graders as well as sixth graders. This is somewhat surprising in light of other evidence suggesting that second graders differ from sixth graders in their processing strategies and in the maturity of their conceptual systems. Perhaps if younger Ss had been used, expected age differences might have been uncovered. Second graders tested in the present study were approaching the end of their school term.

The effects of one other factor were assessed for purposes of control. Prior to the beginning of the experiment Ss were asked to read word strings similar to ones they would encounter subsequently. Out of the 160 Ss, reading skills were found to be deficient in 29, all second graders Seven of these Ss happened to be assigned to each of the verb, maxi, and pair conditions, and four non-readers to each of the mini and conjunction groups. (There were 16 Ss in each condition.) When noun recall means of readers and non-readers were compared for each of these groups, t-tests revealed no significant differences in performance although differences tended to favor the readers slightly. In the maxi group where the largest value of the test statistic emerged, $t\ (14) = 1.20$, $p > .05$. Thus, as was expected, reading ability bore no relationship to performance in the PA task since printed stimulus materials were always read aloud by the E.

Discussion

The capacity of two types of adjective structures to facilitate noun-pair learning was verified in the present study. This contributes two more forms to the class of verbal connectives known to have this effect. It was especially surprising to discover that polar pair contexts produced greater recall than conjunctions, for these contexts involved only the addition of noun modifiers. In a previous study, Rohwer, Schuell & Levin (1967) found that such contexts, identical in form but containing unrelated adjectives (e.g., The running cow and the bouncing ball) did not enhance recall. Cofer (1965) has also shown that when related adjectives are used to modify nouns, the nouns tend to cluster together in memory. These results provide compelling evidence for the operation of adjective structures as mnemonic organizers.

The fact that comparative adjectives were found to be as facilitating as verbs is consistent with other findings (Rohwer & Levin, 1968; Reese, 1970), all challenging hypotheses that the quality or vividness of aroused images or the extent to which the images interact determines how many of the noun pairs will be remembered. Rather it appears that, for maximal facilitation, verbal contexts must simply arouse meaningful relations between nouns.

The finding that verb and comparative forms produced more learning than elaborated noun phrases suggests one other requirement for maximal facilitation. Noun pairs must be embedded in complete sentences. Non-sentence contexts can facilitate learning but not to the extent achieved with kernel sentences which serve to focus upon and make explicit the relations being expressed between nouns. This view of the function of sentence contexts suggests a reason why prepositions have not always been found to facilitate learning. The prepositional contexts used in previous studies (Rohwer, Lynch, Suzuki & Levin, 1967) have not been expressed as sentences but rather as noun phrases (e.g., The shoe on the chair) thus perhaps complicating for the learner the process of focusing on and extracting the semantic relations being expressed.

The failure to detect noun recall differences as a function of the unmarked-marked (or maxi-mini) linguistic contrast suggests that this distinction is not relevant to noun-pair learning. However, it does appear to be related to the process of generating comparative contexts for nouns as indicated by the finding that Ss were more likely to misrecall marked as unmarked terms than to err in the opposite direction (see Table 4). Clark & Card (1969) observed this same asymmetry in their recall data and offer an explanation in terms of semantic feature theory and the relative difficulty of remembering unmarked as opposed to marked terms which have one more semantic feature. However, a slightly different interpretation is preferred here. Antonym pairs are regarded as lexical markers identifying the poles of underlying dimensional structures. In addition, unmarked members of pairs serve as general labels for the dimensions. During learning, Ss assimilate noun pairs to these dimensions and note which pole is involved in the relation. Subsequently during recall, if the specific pole is forgotten, then in their productions learners express the relation in terms of the name of the dimension. Thus, a preponderance of unmarked adjectives is observed in the errors of learners. Although both interpretations of asymmetrical productions are plausible, neither accommodates another finding mentioned above, that maxi-adjective connectives were not recalled better than mini-adjective connectives in the sentence recall task (see Table 3). Perhaps the fact that all comparative adjectives presented to any one learner were of

one type, unmarked or marked, minimized differences in recall otherwise resulting from this factor.

The failure to find first-position prompts associated with superior recall in both the noun recall and sentence recall tasks strengthens claims that meaningful material is represented in memory as a configuration or Gestalt and challenges the associationistic view that mediation consists of sequential verbal chains. Not even learning patterns in the conjunction control group were consistent with the S-R prediction that forward recall would exceed backward recall. Also, results did not support Clark & Card's (1969) claim that surface structure subject nouns being the focus of sentences are more salient in memory than predicates. Of course, findings of the present study are far from conclusive. Clearly serial order effects have been observed by other investigators, and it remains the task of future studies to identify the causes of these discrepancies. Perhaps the extent to which Ss feel compelled to remember and/or produce syntactic surface features accurately determines whether serial position exerts an effect. In the present study, emphasis was upon memory for noun pairs rather than contextual details. That serial order is related to the production of surface structures is suggested by the finding that in the recall of comparative sentences, learners' errors tended to occur more frequently with final noun prompts which were placed in semantically comparable forms but at the heads rather than ends of these forms. Other studies have reported similar generative strategies operating as a function of the noun prompt (Ehri, 1970; Turner & Rommetveit, 1965). This possibility, that syntactic factors such as serial position exert an effect on performance only when syntax is made a salient feature of the task, suggests that in order to resolve discrepancies, investigators must pay closer attention to relationships between the effects of independent variables, performance requirements of the task, and dependent variables being measured.

In accordance with the dichotomy drawn in previous research between imagistic and linguistic accounts of learning facilitation, results of the present study have been depicted as supporting the latter camp. However, several observations exist raising the possibility that this distinction is at root elusive and perhaps illusory when one is attempting to describe how meaning is stored in memory.

First, Rohwer, Lynch, Suzuki & Levin (1967) fail to find evidence for the operation of two distinct coding systems. They reason that if learners possess two memory modalities, then activation of both should enhance learning over activation of only one. However, they find that when action pictures, arousing images, and verb connectives, activating verbal codes, are combined as mnemonics, noun-pair learning is not substantially greater than it is when one or the other mnemonic is presented alone. Furthermore, they find that learning with verbs alone is comparable to learning with pictures alone, disputing the possibility that memory is predominantly visual or verbal. These results raise the possibility that, rather than two parallel mnemonic coding systems, there is only one.

Second, the present as well as previous investigators have been unable to show that imagistic variables such as vividness, specificity, amount of interaction, and extent of overlap produce differential amounts of noun pair learning. Although they do not challenge the operation of images, these results do question whether images constitute a coding <u>system</u> for preserving meaning in

memory.

Third, the linguistic-imagistic distinction is derived from sensory modality differences (i.e., sight vs. speech) yet it is used to describe processes which are central rather than peripheral. One must question to what extent it is necessary to preserve components in their sensory form in a model of memory. Psycholinguists have argued against a sensory-dominated approach in the analysis of linguistic processing. Their research and reasoning demonstrate that the structural knowledge needed to produce and interpret utterances is not revealed in the utterances themselves. Rather abstract deep structures related to surface structures via a series of specifiable transformations must be postulated to account for linguistic capabilities (Garrett & Fodor, 1968). Given this multi-level view of processing, the distinction between verbal and nonverbal mediation is obscured: Do verbal stimuli cease being verbal when they shed their phonological forms? or when they are transformed into deep structures? or when a semantic interpretation is performed?

Researchers who have attempted to contrast verbal and visual mnemonic codes have overlooked these complexities. Aiken (1971) in a study contrasting linguistic and imagistic facilitation of noun pair learning equates linguistic coding with the memorization of sentences. Bower (1970) implies in his discussion of propositional memory that surface structures constitute the verbal form in which stimuli are stored and retrieved. According to a transformational view, however, surface forms are syntactic rather than semantic. They serve to guide the process of extracting meaning but they are irrelevant to the form in which meaning is stored. Sachs (1967a, b) presents evidence in support of this claim, and her data suggest that it is necessary to postulate a deeper level of sentence storage, one which is neither syntactic nor lexical but consists of some non-linguistic embodiment. If this is the case, then it is perhaps meaningless to describe the storage of meaning in terms of a verbal coding system.

The foregoing observations and arguments suggest that rather than perpetuate the dichotomy between imagistic and linguistic coding systems, it is perhaps more reasonable to adopt a point of view which focuses upon the nature of the underlying semantic-conceptual system as it is used to extract meaning from contexts and to impose semantic relations upon stimuli. Given this view, one can conceive of images as semantic elaborators functioning at a deep conceptual level rather than as a separate coding system, and one can explore the relations between images and meaning. Also, this approach is more compatible with the multi-level view of linguistic processing advocated by transformational psycholinguists. Although some supportive evidence exists, it remains for future studies to pursue and elaborate this approach to semantic memory.

In summary, results of the present study provide strong evidence for the operation of antonym adjectives as facilitators of noun pair learning for both younger and older children. The effects of comparative connectives were found to be comparable to the effects of verbs even though overlapping actional images were not aroused in the former case. These findings support the claim that facilitation effects depend primarily upon the arousal of meaningful semantic relations between nouns. However, facilitation effects to be maximal appear to require in addition the explicit statement of relations in the form of sentences rather than noun phrases. Rather than offering results as support for linguistic as opposed to imagistic interpretations of memory, an argument was constructed in which both representational forms were assigned a role in a general processing model.

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Table 1

Mean Number of Nouns Recalled as a Function of Grade and Verbal Context (maximum = 8)

	Verbal Context					
Grade	Verb	Maxi	Mini	Pair	Conj.	Total
Second	4.72	4.28	4.50	3.31	2.33	3.83
Sixth	5.88	5.31	4.98	4.56	3.63	4.87
Total	5.30	4.80	4.74	3.94	2.98	4.35

Note: MSE (140) = 8.17

Table 2

Mean Number of Nouns Recalled as a Function of Grade and Trials (maximum = 8)

	Trial		
Grade	1st	2nd	Diff.
Second	2.99	4.67	-1.68
Sixth	3.81	5.93	-2.12
Total	3.40	5.30	-1.90

Note: MSE (140) = 8.17

Table 3

Mean Number of Connectives Recalled Correctly as a Function of Verbal Context (maximum = 8)

Verbal Context				
Verb	Maxi	Mini	Pair	Total
4.81	4.81	4.66	3.78	4.52

Note: $\underline{MSE}$ (112) = 5.62, $\underline{T}\sqrt{\underline{MSE}}$ = 1.09, $\underline{p} < .05$.

Table 4

Total Number of Comparative Sentence Transformations Produced During the String Recall Task as a Function of the Noun Prompt's Position in the Original Sentence

	Transformation		
Prompt	Maxi => Mini	Mini => Maxi	Total
First noun	4	15	19
Final noun	15	30	45
Total	19	45	64